ROYAL ASTRONOMICAL SOCIETY.

Vol. II. *November* 9, 1832. No. 15.

The following communications were read :—

I. Observations of Biela's Comet, by Sir J. F. W. Herschel.

" The moon being sufficiently removed from the presumed place of this interesting object, and the promising aspect of the evening of the 22d September last holding out hopes of detecting it by the powerful light of the 20-feet reflector, I directed that instrument, with a newly-polished mirror, to a point of the heavens determined by taking a mean of the right ascensions and declinations, calculated by M. Santini from his own and from Damoiseau's elements. A haze, however, which, as the evening advanced, rapidly increased to a decided cloud, disappointed my expectations for that night; but on the following evening, the sky being perfectly clear, after sweeping to and fro for about five minutes over the place similarly calculated for the time of observation, I had the satisfaction of seeing the comet enter the field as a conspicuous nebula of about $2\frac{1}{2}'$ or $3'$ in diameter, and of such a degree of brightness as would entitle it to a place in my father's first class, or 'bright nebulæ.' It had no tail; and though its rate of increase of density towards the centre was rather more rapid and decided than about the circumference, yet there was nothing in the least entitled to the name of a nucleus. As no nebula exists in that part of the heavens which could be confounded with an object of this description, it was of course immediately recognised as the object sought: but had I entertained any doubt of its identity, it would have been dispelled by its motion, which, during an hour and a half, or thereabouts, that I kept it in view, was very considerable. At the commencement of my observation, it formed an irregular trapezium with three pretty bright stars, A, B, C; with two of which I measured its angles of position, and, on repeating the measures after a short interval, found them sensibly altered. The change of place speedily became remarkable to the eye, and was such as to carry the comet towards two or three other pretty bright stars, D, E, in a distant part of the field. In approaching these, it passed directly over a small cluster or knot of minute stars, of the 16th or 17th magnitude, which occupied a space about a minute or two in diameter; and, when on the cluster, it presented the appearance of a nebula resolvable, and partly resolved, into stars, the stars of the cluster being visible through the comet.

" A more striking proof could not have been offered of the extreme translucency of the matter of which this comet consists.

The most trifling fog would have entirely effaced this group of stars; yet they continued visible through a thickness of the cometic matter, which, calculating from its distance and apparent diameter, must have exceeded 50,000 miles, at least towards its central parts. That any star of the cluster was *centrally* covered is, indeed, more than I can assert; but the general bulk of the comet may certainly be said to have passed centrally *over the group*.

"The reflector being at that time in a great measure dismantled, for the purpose of making some changes in the sweeping apparatus, I was unable to determine, as I could have wished, the place of the comet by an extra-meridian sweep; I was, therefore, obliged to have recourse to the 7-feet equatorial (aperture 5 inches), with which, at best, I could only hope to procure an approximate place; and from my knowledge of its comparative inefficiency in shewing nebulæ, I had very slender expectation of being able to see it at all. However, by carefully noting in the finder of the large instrument the exact *locality* of the spot with respect to the stars θ, ν, and τ *Aurigæ*, I was enabled, with no great difficulty, to find the telescopic constellation consisting of the stars A, B, C, D, E, with which I had compared the comet in the reflector; and, after very long and careful attention in a field totally dark, and without the smallest light in the observatory, I succeeded in obtaining a sight of the comet in the place where, from its motion during the interval, I expected to find it. Under such circumstances, any determination of its place must be exceedingly vague; and, in fact, on reducing three comparisons which I obtained, directly and indirectly, of its place with that of θ *Aurigæ*, it became evident that in one of them I must have mistaken a retinal spectrum produced by nervous excitement, for the comet. For their results when reduced gave as follows, (calling α and δ the right ascension and declination of θ *Aurigæ*, and α' δ' those of the comet):

By the first comparison... $\alpha' = \alpha - 8^m\ 4^s$ ..... $\delta' = \delta - 53'\ 30''$
..... second..... $\alpha' = \alpha - 9\ \ 9$ ..... $\delta' = \delta - 59\ \ 0$
..... third..... $\alpha' = \alpha - 7\ 51$ ..... $\delta' = \delta - 55\ 48$

The sidereal times of observation (corrected for the clock's error) being respectively $3^h\ 53^m\ 41^s{,}5$, $4^h\ 32^m\ 40^s{,}5$, $4^h\ 51^m\ 36^s{,}5$. The second of these results must evidently be rejected for the reason above mentioned; whence the mean of the two others gives, for $4^h\ 25^m\ 29^s{,}5$ sid. time,

$$\alpha' = \alpha - 7^m\ 57^s{,}5 \ldots\ldots \delta' = \delta - 54'\ 39''.*$$

"At $4^h\ 51^m\ 36^s{,}5$, sid. time, the comet was compared with a small double star, whose approximate place for 1830·0 was found, by comparison with θ *Aurigæ*, to be

$$\text{R}\ 5^h\ 40^m\ 54^s{,}5\ ;\ \text{Decl.} + 36°\ 13'\ 31''.$$

The stars composing this double star are about the 8th and 9th

* The mean place of θ *Aurigæ*, brought up to Jan. 1, 1832, by the precession assigned in the Astronomical Society's Catalogue, is

$$\text{R}\ 5^h\ 48^m\ 15^s{,}6\ ;\ \text{Decl.} + 37°\ 11'\ 33''.$$

magnitudes; their distance, roughly taken, about 65 parts of the micrometer = 15″; and their angle of position 13° 20′ *sf* = 103° 20′. This description will enable any observer easily to identify and re-observe the double star in question. The comet, at the time above stated, *preceded* the double star 38 seconds of time, and was found, by a micrometric estimation (for I cannot call it a measure) to be about 550 parts = 2′ 12″ *North* of it.

" On the next night, I again observed the comet with the 20-feet reflector, and again found it without the least difficulty. It was very little, if at all, perceptibly brighter or larger than the preceding night; but had entirely deserted its former place, and was now near a single, pretty bright star, of fully the 10th magnitude, insulated in the field, and easily identifiable. The approximate place of this star for 1830·0 I found, by comparison with θ by the equatorial, to be $\mathcal{R}$ 5^h 45^m $18^s,0$; Decl. + 36° 13′ 31″.

" I procured, through the intervention of this star, two indirect comparisons of the comet with θ *Aurigæ;* in both of which I was, however, obliged to *estimate* the difference of declinations of the comet and star at 2′, by reason of the excessive feebleness of the former, which rendered all measurement impracticable. I also compared it twice *directly* with θ; but of these comparisons, one when reduced, proved to have been an illusion of the kind above mentioned; I therefore suppress its result. Those of the others were as follow:—

	h m s	m s	° ′ ″
By intervention of the small star, 1st comparison	$t = 2\ 1\ 4$ sid. time;	$\alpha' = \alpha - 2\ 28{,}5$;	$\delta' = \delta - 1\ 0\ 0$
By ditto, 2d ditto	$t = 3\ 1\ 4$	$\alpha' = \alpha - 2\ 14{,}5$;	$\delta' = \delta - 1\ 0\ 0$
By direct comparison with θ	$t = 2\ 30\ 46$	$\alpha' = \alpha - 2\ 25{,}0$;	$\delta' = \delta - 1\ 1\ 0$
Mean	$t = 2\ 30\ 58$	$\alpha' = \alpha - 2\ 23{,}5$;	$\delta' = \delta - 1\ 0\ 20$

" The following night it proved cloudy, and my attention being distracted to other objects, I have not since pursued the comet; nor should I have thought it worth while to communicate observations confessedly so imperfect as the present, to the Society, but for the high interest attaching to the object, as well as for an impression left on my mind, by the excessive feebleness of its light as seen in the equatorial, that it may have escaped the notice of most observers at this early period of its appearance, for want of light, as I am certain I could never have found it by any degree of attention with that instrument, had not its precise place been given by the 20-feet reflector.

" I know not whether I may be pardoned the mention of a conjecture in this place, as to the origin of a very striking phenomenon in the history of comets, which seems to have been satisfactorily established, at least in some instances, by positive observations; which is, their dilatation of volume as they recede from, and concentration within a smaller compass as they approach, the sun. This phenomenon has been attempted to be accounted for by a supposed *pressure* of the ether, whose density is assumed to

increase in the sun's vicinity. But, not to mention that the effect would not follow from the cause without supposing the matter of the comet impermeable to the ether (as a sponge is not compressed by lowering it in water unless enclosed in a water-tight case), it appears to me that the phenomenon is explicable on a much less gratuitous supposition; viz. that of the extremely feeble attractive force by which the matter of a comet must be held together, owing to the probable extreme minuteness of its mass. *Cohesion* can hardly be supposed to exist in a gaseous or nebulous body of such tenuity; so that the only bond of union between its molecules must be their feeble gravitation to each other, which is hardly more than mere juxtaposition in space. Hence we must regard each molecule as constituting almost a separate, independent projectile, describing its own parabola about the sun. Now, the interval between two or more parabolas described about a common focus, and having their axes coincident, is a minimum at the perihelion, and increases as we recede from it, in a ratio easily calculable. The volume, on this view of the subject, ought to increase in the sesquiplicate ratio of the radius vector. The observations of Encke's comet, cited by M. Arago, indicate, no doubt, a much more rapid law of increase; but, not to mention the difficulty of obtaining any positive measures of a body so ill-defined as a comet, the circumstances under which the observations must necessarily be made have a powerful tendency to exaggerate the effect; since, in proportion as a comet recedes from the sun, it is continually seen projected upon a darker and darker part of the heavens as it emerges from the twilight; in consequence of which, exterior strata of the nebulosity become perceptible which were incapable of affecting the eye before. Those who are at all conversant with the observation of nebulæ, will not fail to have remarked the rapid rate of the obliteration produced by very trifling degrees of illumination, natural or artificial, of the field of view. Now, it is precisely on comets or nebulæ, whose condensation towards the centre is feeble and which (like the comets of Encke and Biela) have no nuclei, that this action is most powerful, and its effect most extensive. I would not, however, be understood by any means to deny the reality of a more rapid law of variation than that which results from the foregoing consideration. If it subsist, of course we must look out for another explanation. At all events, the conclusion we have arrived at, regarded as a geometrical result, is not devoid of a certain degree of interest; and the cause I have assigned, having the character of a *vera causa*, cannot be excluded from some share in the production of the observed effect, even should it not be found sufficient to account for the whole.

"There is, however, another way in which the apparent dimensions of a comet may be conceived to vary with its proximity to the sun, while its real volume may remain unaltered, or even undergo a contrary change. The nebulous portion of the comet, or that which reflects the sun's rays, is not improbably of the nature of a fog, *i. e.* a collection of discrete particles of a vaporisable fluid floating in a

transparent medium. Now, as these molecules, during the comet's approach to the sun, absorb its rays and become heated, a portion of them will be constantly passing from the liquid and visible to the gaseous and invisible state. As this change must commence from without and be propagated inwards, the effect will be a diminution of the comet's visible bulk. On the other hand, in its recess from the sun, it will part with the heat thus acquired by radiation, which, in conformity with the general analogy of radiant caloric, will take place chiefly from the unevaporated or nebulous mass within, whose dimensions will therefore begin and continue to increase by the precipitation immediately above it of fresh nebulous matter, just as we see fogs in cold still nights forming on the surface of the ground, and gradually extending upwards as the heat near the surface is dissipated. The comet will thus appear to enlarge rapidly in its visible dimensions, while the real *volume* is in fact slowly shrinking by the general abstraction of heat from the mass.

"This process might go on in the entire absence of any solid or fluid nucleus; but supposing such a nucleus to exist, and to have acquired a considerable increase of temperature in the vicinity of the sun, evaporation from its surface would afford a constant and copious supply of vapour, which, rising into its atmosphere and condensing at its exterior parts, would tend yet more to dilate the visible limits of the nebula. Some such process would naturally enough account for the appearances which have been noticed in the heads of certain comets, where the stratum, void of nebula, has been observed interposed, as it were, between the denser portion of the head or nucleus and the coma.* It is analogous to the meteorological phenomenon of a definite *vapour plane*, so commonly observed; and, in certain cases, may admit of two or more alternations of nebula and clear atmosphere.

"If, however, after all, we should prefer to call in an ethereal medium surrounding the sun, as the sole or partial cause of the remarkable phenomenon in question, it will not be necessary to have recourse to the idea of condensation arising from its mechanical pressure, which, as we have seen, is repugnant to what we know of the mode of propagation of pressure in fluids. A less repugnant explanation offers itself in the presumable habitudes of the ethereal fluid with respect to heat. Fourier has rendered it not improbable, that the region in which the earth circulates has *a temperature* of its own, greatly superior to what may be presumed to be the *absolute* zero, and even to some artificial degrees of cold; and, in my *Essay on the Study of Natural Philosophy*,† (p. 157), I have shewn, I think satisfactorily, that if this be the case, such temperature cannot be due simply to the radiation of the stars, but must arise from some other cause, such as the contact of an ether possessing itself a determinate temperature, and tending, like all known fluids, to

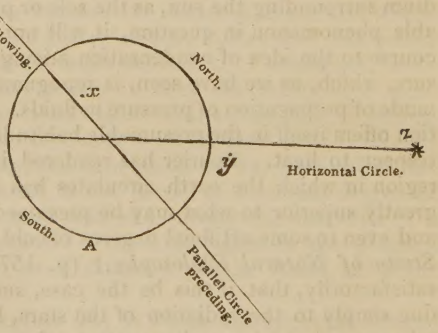
* See my father's observations on the comet of 1811.

† See also my paper on the astronomical causes of geological phenomena.

communicate this temperature to bodies immersed in it. Now, if we suppose the temperature of the ether to increase as we approach the sun,—which seems a natural, and, indeed, a necessary consequence of regarding it as endued with the ordinary relations of fluids to heat,—we are furnished with an obvious explanation of the phenomenon in question. A body of such extreme tenuity as a comet may be presumed to take very readily the temperature of the ether in which it is plunged; and the vicissitudes of warmth and cold thus experienced may alternately convert into transparent vapour, and re-precipitate the nebulous substance, just as we see an increase of atmospheric temperature dissipate a fog, not by abstracting or annihilating its aqueous particles, but by causing them to assume the elastic and transparent state which they lose, and again appear in fog when the temperature sinks."

In a subsequent letter to Mr. Baily, Sir J. Herschel gives an account of a further observation obtained on the morning of the 4th November. The following is an extract:—

"After watching in vain for an opportunity of renewing my observations of the comet on the mornings of the 2d and 3d instant (Nov.), the cloudy state of the sky on both mornings from 2 A.M. till day-break precluding all possibility of observing it, I succeeded, on the morning of the 4th, in getting a very satisfactory observation. Having set the 20-feet reflector on the spot indicated by Mr. Henderson's Ephemeris, I had hardly made two or three azimuthal sweeps of the tube to and fro, when it made its appearance in the field of view as a large and very bright nebula. Judging of its light as compared with that of two nebulæ of the 2d class which occurred in the first azimuthal sweep, I should say that its impression on the eye was at least 100 times that of one of the nebulæ. I judged its diameter to be full 4′. The condensation towards the middle was considerable, and the centre itself was occupied by a bright point about equal to a star of the 13th magnitude. It had no decided tail, but only a feeble trace of some extension of its nebulosity in a direction about 40° N.P. from the parallel.



"At $5^h\ 53^m\ 21^s$ sidereal time at Slough, the comet preceded a star x of the 10th magnitude, $11^s{\cdot}0$ of time, and its position from the star, taken by the position-micrometer used in my observations of double stars (for which its own light afforded ample illumination), was $274^\circ{\cdot}0$, so that the comet's centre was at that time $11''{\cdot}4$ north of the star.

"A large star of 5·6 mag., which proved to be *z Leonis* (Fl. 43), preceded the comet about a minute and a quarter of time, by rough estimation, and was judged to be about 13′ or 14′ to the south of it; but as my field of view would not take in both objects, I was about to have recourse to the equatorial, when it clouded. At this time the comet was rapidly approaching the star *x*, which had even begun to be involved in the extreme borders of its nebulosity. Its path, as nearly as I could judge, would have carried its centre about 40″ south of the star.

"The next night (Nov. 4–5) was unfavourable, clouds persisting obstinately in resting on and about the comet's place, while the horizon elsewhere was generally clear. However, as a star of the 10th magnitude is visible in my reflector through a pretty thick cloud, I succeeded in ascertaining the place of the star *x* of last night's observation with sufficient exactness to secure its identification, should any one be inclined to re-observe it. It follows 43 (*z*) *Leonis* $1^m\,32^s{\cdot}2$ of time, and is about 12′ 47″ north of that star; so that its approximate place for 1832·0 will be $\mathcal{R}$ $10^h\,15^m\,44^s{\cdot}8$; Decl. + 7° 36′ 23″; which I apprehend to be within 1^s of the truth in $\mathcal{R}$, and 1′ in decl.; and hence the approximate place of the comet at the epoch of the preceding night's observation must have been, $\mathcal{R}$ $10^h\,15^m\,34^s$; Decl. + 7° 36′ 34″. The place for the same epoch, interpolated from Mr. Henderson's Ephemeris, computed from Damoiseau's Elements, is $\mathcal{R}$ $10^h\,12^m\,30^s$; Decl. + 8° 17′.

"It was not till about 8^h sid. time that the clouds were sufficiently dispersed from the comet's place to allow a view of it. Being then, however, at a much greater altitude than when seen last night, it was proportionally brighter, and was, indeed, a very fine and brilliant object. The trace of a tail or branch in the same direction as last night, though extremely feeble, was now unequivocal, and the central point not to be overlooked. It had not, however, the appearance of a star, but seemed more analogous to the central point in some nebulæ, such as that in *Andromeda*, which is probably only nebula much more condensed than the rest. The comet's diameter could not be estimated under 5′, and I suspected some degree of nebulosity even beyond that limit.

"At $8^h\,8^m\,29^s$ sid. time at Slough, the comet's centre followed a star *w* in the field, almost exactly $1^s{\cdot}5$ north of it, (a good observation). The comet being then allowed to run along the middle wire, so as to traverse a diameter of the field while the star traversed a chord, I found the times occupied to be respectively $57^s{\cdot}5$ and $25^s{\cdot}5$, which gives for their difference of declination 6′ 24″, the comet being south of the star. The star *w* is a conspicuous one, of fully the 9th mag., and there is no other which can be mistaken for it. A star of the 10 mag. precedes it about 20^s of time, and is about $2'\frac{1}{2}$ south of it; but except this there is no other considerable star within *at least* 10′ in all directions. The comet's daily motion (obtained per Ephemeris) may therefore be safely used to identify this star. Admitting, then, that in the interval ($26^h\,15^m$ S.T.) elapsed since the last observation the comet had moved over

+ $6^m\ 20^s$ in $\mathcal{R}$, and — 1° 10′ 3″ in decl., we get for the approximate place of the star *w* for 1832·0,

$$\mathcal{R} = 10^h\ 21^m\ 52^s;\ \text{Decl.} +6°\ 32'\ 55''."$$

Mr. Best presented a diagram of the path of the comet from Oct. 30 to Nov. 14.

II. On a Method of Ascertaining the Rate of Chronometers; especially when a strict examination of their performances is required. By Mr. James Epps, Assistant Secretary of the Society.

For the purpose of obtaining the rate of a mean-time chronometer with the greatest accuracy, Mr. Epps recommends that the comparisons should be made directly with the transit clock by the *coincidence of beats*. The transit clock, in almost every instance, beats seconds of sidereal time, and the ship or box chronometer half seconds of mean solar time. This is the case which will be illustrated; but the principle of the method is the same whatever be the beat of the timekeepers to be compared, provided the one be regulated on sidereal and the other on mean solar time.

It will be generally admitted that the passages of well-known stars over the meridian observed by a transit instrument, either perfectly adjusted, or the errors of which are known and allowed for, afford the most exact and easy means of ascertaining the *absolute error* of a clock; and also that the *rate* of the clock is determined more readily still from a series of such observations. Again, as 6^m of solar are nearly equal to $6^m\ 1^s$ of sidereal time, it is evident that in about 6^m, a solar chronometer will lose two vibrations upon a sidereal clock, and one vibration in 3^m; so that if the two timekeepers beat together at any time, they will at the end of 3^m beat together again, the chronometer having lost $0^s{\cdot}5$ on comparing the readings. This *coincidence* is determinable more or less accurately according to the experience of the observer and the delicacy of his ear. It would be impossible for any one to be mistaken half a minute in this estimation, and such a mistake would not cause an error of $0^s{\cdot}1$ in the actual *comparison;* but it is possible, when all circumstances are favourable, to determine the coincidence within 6^s, which gives the comparison exact to $0^s{\cdot}02$, that is, without sensible error; so that the error and rate of the chronometer may be determined with as much certainty as those of the transit clock itself. It is evidently impossible to compare a chronometer and a clock in the common method with any thing like the same accuracy.

When merely the *rate* of a chronometer is required, and this is commonly the case, there is no need of determining the *absolute error* of either clock or chronometer. The practice adopted by Mr. Epps may be explained as follows: Every day the chronometer is compared with the clock, and the second of each, at which the coincidence is judged most nearly to take place, noted down. The hour and minute of one timekeeper may be set down at leisure. These Mr. Epps arranges in parallel columns. Next day, and suppose at the same time, the comparison is made again, and the results set down under the former in their respective columns. If, then, the

upper quantities be subtracted from the lower, we have the same portion of duration differently expressed; the first of which would be in mean solar, and the latter in sidereal time, if the chronometer and clock went correctly. Hence, after subtracting the acceleration from the sidereal-time interval, or adding the retardation to the mean-time interval, the two should agree, and the difference which is actually found must arise from the *variations* of the timepieces, that is, from the *difference of their rates.* Now, the rate of the transit clock is supposed to be known by observation, and this being applied with the proper sign to the difference just found, the result will be the *rate of the chronometer;* but as the interval will scarcely ever be exactly 24 hours, the difference of the rate must be multiplied by the fraction $\frac{24^h}{\text{interval elapsed}}$ before the application of the daily rate of the clock; which may be done conveniently by the help of a small table. It is evident, also, that when the rates are tolerably close, the only use in noting the hours and minutes is for the purpose of taking out the acceleration correctly, and of obtaining a proper factor to reduce the difference of rates to a 24-hours' rate. Thus the hours and minutes of one of the timekeepers may be neglected, as well as the minutes of the acceleration, &c., which saves a little time and trouble in setting down the comparisons and obtaining the final rate.

III. Observations of the Transit of *Mercury* of May 5, 1832.

1. M. Quetelet, director of the observatory of Brussels, states that the clouds prevented his observing the ingress. The times of egress were as follow, in which allowance has been made for the rate of the chronometer. The telescope used was a reflector with a power of 90:

		d	h	m	s	
Meridian transit of *Mercury* ...	May	4	23	59	55,2	Mean time.
Internal contact at egress		5	4	2	52	
External do			4	6	1	

2. Mr. Henderson, astronomer at the Cape of Good Hope, made the following observation. The external contact at ingress was obtained by estimation, *Mercury* having been first seen on the sun at $22^h\ 16^m\ 2^s$:

		d	h	m	s	
External contact at ingress, ...	May	4	22	15	56	Mean time.
Internal do			22	19	12	
Internal contact at egress		5	4	58	25	

It was impossible to observe the external contact at ingress, owing to the undulation of the sun's limb, which was then little more than one degree above the horizon.

3. Extract of a letter from Captain Bayfield, R.N. to Captain W. H. Smyth, R.N.

"The transit of Mercury which took place on the 5th of last month, commenced before day-light; but I observed its termination as follows:

Saturday, May 5 11^h *civil;* or May 24 23^h, *astronomical* time.

	h	m	s	
Egress of ☿'s first limb	11	5	33,4	Apparent
..... second limb ...	11	9	2,4	time, A.M.

"The observation was made with one of Jones's 3½ feet achromatic refractors. The weather was tolerably clear, and the time well determined by numerous equal altitudes, with a large and excellent instrument, and an artificial horizon, on the same day. Position of the place of observation, latitude 46° 48′ 50″ N.; longitude 71° 16′ W."

4. Extract of a letter from Captain R. Owen, R.N. to Captain Beaufort, R.N.

		d	h	m	s	
Internal contact at egress ...	May	4	22	49	49	Mean time.
External do.....				53	4	

Flag-staff, Crooked Island { Latitude... 22° 47′ 20″ N. Longitude 74 18 0 W.

Power of telescope, 120.

5. Observation by Captain Belcher, R.N. at Cavalho Island, Bijoogas.

		h	m	s
Gaining rate of watch on mean time		0	0	3,984
Internal contact at ingress	May 4	9	9	34,2
Do. egress	5	3	50	26,5
External contact at egress			53	52,0

Instrument, reflecting telescope G 20, indifferent, vibration excessive.

The internal egress observed by Lieutenant Kellet, with a powerful refracting telescope of 42 inches, corresponded with the above.

6. Extract of a letter from M. Cacciatore to the Foreign Secretary.

"The transit of Mercury of May 5 was fortunately observed here. The day was fine; but some slight clouds made the sun's limb undulate during the egress.

	Sidereal.			Mean.		
	h	m	s	h	m	s
Internal contact at ingress...	0	49	09,7	21	0	19,8
Do. egress...	7	32	59,8	3	46	59,7
External contact at egress...	7	35	49,9	3	49	49,3

IV. Observations of the Occultation of 104 *m Tauri* of October 13; and of *μ Ceti* of November 7, 1832. By Mr. Snow. Accompanied by the transits of the stars which were used to correct the clock.

1832. October 13. Observed in Saville Row.

Immersion of 104 *m Tauri* (5th mag.) $3^h\ 35^m\ 44^s,7$ sid. time.

The star vanished gradually, as if it had been a small planetary body. Telescope, 45-inch refractor, power 180; adjusted to the star.

1832. November 7. Observed in Saville Row.

Immersion of *μ Ceti* (4th mag.) $23^h\ 35^m\ 41^s,10$ sid. time.

Telescope 45-inch refractor, power 40, adjusted to the star. The star was very sharp and distinct; and although the immersion took place at the moon's dark limb, (the moon wanting about 12 hours of being full), the star did not disappear until it actually reached the enlightened portion of the moon's disk: the star then vanished, *not quite instantaneously*, but suffered no previous diminution of light or change of colour.

V. Observations of the Occultation of *Saturn* of May 8.

1. By Professor Airy and Mr. Maclear, at Cambridge.

Sidereal Time.

Immersion.	AIRY. h	m	s	MACLEAR. h	m	s
First limb of ring touched the Moon	—	—	—	12	12	49,91
First limb of ball touched the Moon	12	13	6,77		13	12,41
Second limb of ball disappeared		14	4,23		14	4,41
Second limb of ring disappeared		14	34,62		14	36,11

The telescope used by Mr. Maclear is more steadily mounted than that used by Professor Airy: in other respects there is little difference between the instruments.

2. By M. Cacciatori, at Palermo.

	Sidereal Time. h	m	s	Mean Time. h	m	s
Immersion.						
First limb of *Saturn* touched the Moon	13	39	42,9	10	40	45,15
Second limb disappeared.....		40	26,8		41	28,93
Second limb of ring disappeared.....		40	53,7		41	55,76
Emersion.						
Second limb of *Saturn* reappeared	14	44	18,8	11	45	10,48
Second limb of ring reappeared		44	30,8		45	22,45

There was a slight haze in the atmosphere. On emerging, *Saturn* shone faintly for 20^s, and then resumed its usual splendour.

VI. Stars observed with the Moon at the Royal Observatory, Greenwich, in the months of June, July, and August, 1832.

		Time by Transit Clock. h	m	s	Daily Rate. s
June 13.	52 Ophiuchi.....	17	25	17,82	
	D ———		33	27,56	— 0,85
	(323) Sagitt.....		52	41,50	
	☽ 2 L	18	3	38,08	
July 8.	☽ 1 L	16	2	23,36	
	χ Ophiuchi		18	6,06	— 0,60
	φ ———		22	20,28	
12.	π Sagittarii	19	0	32,08	— 0,80
	☽ 2 L.....		31	59,58	
Aug. 7.	(323) Sagittarii	17	52	37,08	
	☽ 1 L.....	18	19	21,70	
	ξ^2 Sagittarii		47	43,34	
8.	ξ^2 Sagittarii	18	47	42,60	
	☽ 1 L	19	11	43,52	
	(138) Sagittarii.....		20	55,86	
	57 ——— ...		42	26,32	
11.	ι Capricorni	21	12	51,80	
	(154) Aquarii		21	26,28	
	γ Capricorni....		30	45,08	
	☽ 2 L.....		47	53,94	

VII. Observations of the Transits of the Moon with Moon-culminating Stars, made at Cambridge Observatory in the months of August,* September, and October, 1832.

		Time of Transit. h m s	Clock's losing rate. s
Aug. 7.	μ^1 Sagittarii	18 0 52,13	2,88
	Moon 1 L	16 28,85	
	ξ^2 Sagittarii	44 51,36	
8.	ξ^2 Sagittarii	18 44 48,48	2,85
	Moon 1 L	19 8 48,42	
	(138 Sagittarii)	18 1,63	
	57 Sagittarii	39 32,11	
11.	ι Capricorni	21 9 50,15	2,95
	(154) Aquarii	18 24,75	
	γ Capricorni	27 43,51	
	Moon 1 L	42 44,20	
	Moon 2 L	44 51,83	
Sept. 4.	Moon 1 L	18 48 50,34	3,05
	(138) Sagittarii	19 16 43,87	
5.	(138) Sagittarii	19 16 40,91	2,95
	Moon 1 L	41 3,82	
	π Capricorni	20 13 27,46	
6.	π Capricorni	20 13 24,10	3,02
	Moon 1 L	32 45,56	
8.	Moon 1 L	22 13 38,80	3,17
	70 Aquarii	35 15,23	
10.	(126) Aquarii	23 22 21,67	3,01
	Moon 2 L	53 52,36	
19.	β Geminorum	7 30 2,49	2,93
	Moon 2 L	8 22 41,57	
Oct. 2.	ξ^2 Sagittarii	18 47 7,88	2,71
	o ———	54 2,45	
	Moon 1 L	19 24 26,80	
5.	δ Capricorni	21 37 2,90	3,04
	Moon 1 L	57 43,05	
	D Aquarii	22 9 16,60	
6.	σ Aquarii	22 20 59,20	2,99
	Moon 1 L	47 12,70	
	ψ^3 Aquarii	23 9 27,70	
8.	p Piscium	23 49 12,66	2,97
	s Piscium	55 52,54	
	Moon 1 L	0 25 39,50	
10.	ν Piscium	1 31 43,81	3,15
	Moon 2 L	2 9 32,67	

* In the month of July the moon was several times observed, but it was never possible to observe one of the moon-culminating stars.

J. Moyes, Castle Street, Leicester Square.